

THE FEDERAL PLAN FOR METEOROLOGICAL SERVICES AND SUPPORTING RESEARCH

FISCAL YEAR 2005 EXECUTIVE SUMMARY

For Fiscal Year (FY) 2005, the President's budget requests a total of \$3.18 billion for meteorological services and supporting research. Of the requested total, \$2.73 billion is designated for operations and \$443 million for supporting research. Table ES-1 lists a breakout of the FY 2005 budget proposal.

For FY 2005, 90.1 percent of the total funds requested will go to the Departments of Commerce (DOC), Defense (DOD), and Transportation (DOT). The distribution among these three departments is DOC 58.3 percent, DOD 17.1 percent, and DOT 14.7 percent. The other Federal agencies will share the remaining 9.9 percent.

By comparison, the FY 2005 request represents an increase of just 0.1 percent above the \$3.17 billion appropriated in FY 2004. Within the three major departments, DOC requests an increase of 3.6 percent; while DOD (4.9 percent) and DOT (2.2 percent) each request a decrease. The DOC

increase is attributable to requests for increases by NWS, NESDIS, and NOS. The overall DOD decrease is mainly the result of sizeable decreases in DMSP (14.7 percent) and Army (33.1 percent). DOT's 2.2 percent decrease is largely attributable to reductions in FAA's operations and supporting research requests.

The budget requests for the other departments are as follows: Department of Agriculture (USDA) a decrease of 16.4 percent, Department of the Interior (DOI) no change, Environmental Protection Agency (EPA) an increase of 3.1 percent; National Aeronautics and Space Administration (NASA) a decrease of 6.3 percent; and Nuclear Regulatory Commission (NRC) an increase of 140 percent.

Figure ES-1 depicts each agency's proportion of the requested FY 2005 Federal budget for meteorological operations and supporting research. Each agency's portion of the requested

funding for meteorological operations is shown in Figure ES-2. Of the \$2.73 billion requested for meteorological operations, DOC, DOD, and DOT account for slightly over 98.7 percent of the funds. Overall, operational costs increased by 1.8 percent. Figure ES-3 depicts each agency's portion of the proposed Federal supporting research budget. Unlike operations, DOC, DOD, and NASA account for the major share (85.3 percent) of the supporting research budget. Other requests for supporting research funds are: decrease in NASA (6.5 percent), increase in DOT (2.4 percent); decreases in DOD (18.2 percent) and DOC (15.5 percent); and an increase in EPA (3.1 percent).

All agencies project a personnel total of 14,620 full-time equivalent (FTE) to be employed in Federal meteorological operations in FY 2005. This figure represents a decrease of 1.1 percent from the 14,783 FTE employed in FY 2004.

Table ES-1. Federal Budget for Meteorological Operations and Supporting Research, FY 2005 (in thousands of dollars)

Agency	Operations	% of TOTAL	Supporting Research	% of TOTAL	TOTAL	% of TOTAL
Agriculture	\$12,018	0.4	\$27,431	6.2	\$39,449	1.2
Commerce	1,768,220	64.7	83,377	18.8	1,851,597	58.3
Defense	492,612	18.0	49,526	11.2	542,138	17.1
Homeland Security	17,030	0.6	0	0.0	17,030	0.5
Interior	2,400	0.1	0	0.0	2,400	0.1
Transportation	438,146	16.0	28,445	6.4	466,591	14.7
EPA	0	0.0	9,000	2.0	9,000	0.3
NASA	2,544	0.1	245,100	55.3	247,644	7.8
NRC	120	0.0	0	0.0	120	0.0
TOTAL	\$2,733,090	100.0*	\$442,879	100.0*	\$3,175,969	100.0

* Column total does not exactly equal 100 percent due to roundoff error for several agencies.

Total = \$3.18 Billion

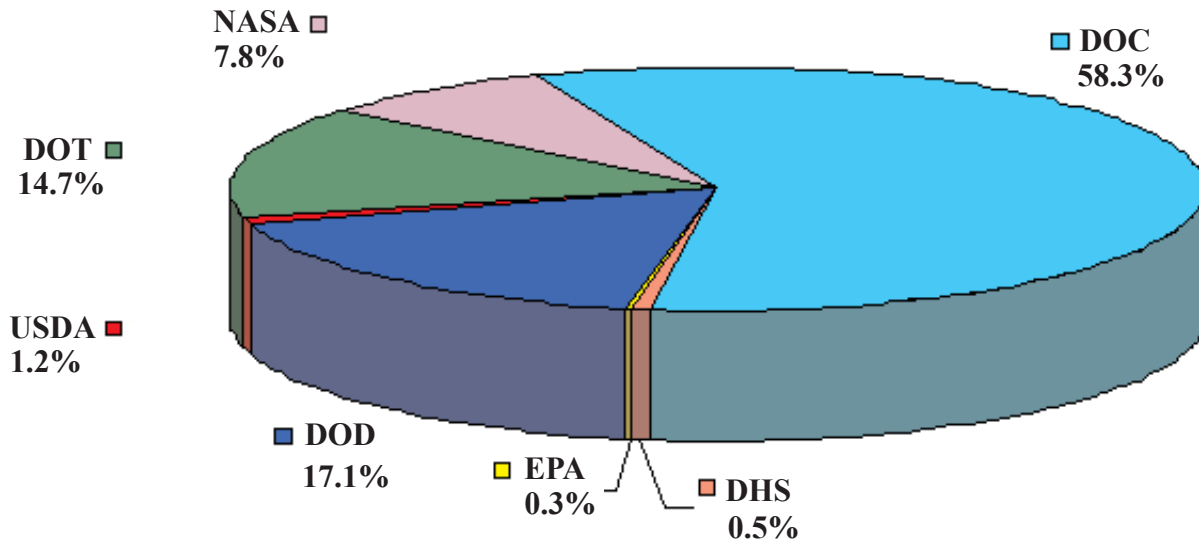


Figure ES-1. Agency Percent of Total Federal Budget for Meteorological Operations and Supporting Research, FY 2005.

Total = \$2.73 Billion

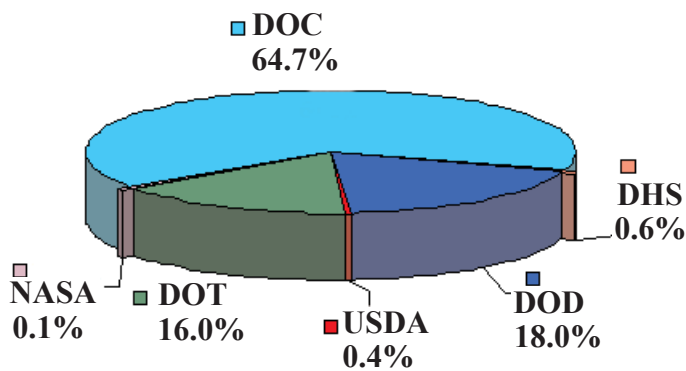


Figure ES-2. Agency Percent of Federal Budget for Meteorological Operations, FY 2005.

Total = \$443 Million

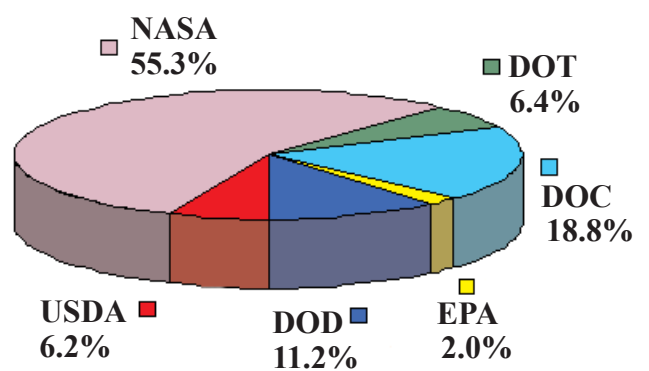


Figure ES-3. Agency Percent of Federal Budget for Supporting Research, FY 2005.

MAJOR PROGRAMS--DOC, DOD, and DOT

NEXT GENERATION WEATHER RADAR (NEXRAD). The NEXRAD Program which began in FY 1981 was responsible for procurement, installation, and operation of the Weather Surveillance Radar-1988 Doppler (WSR-88D). The first limited production WSR-88D system was installed at Oklahoma City, Oklahoma in May 1990, and commissioned 4 years later in February 1994. The original program plan called for a total of 161 radars. In response to a National Research Council report, three additional radars were added and raised the total to 164 radar sites.

As of June 2004, the DOC/National Weather Service had commissioned 120 sites, the DOD (USAF and Army) had commissioned 29 sites (within the states and overseas), and the DOT/FAA had commissioned 12 sites. DOD has three systems at Keesler AFB, Mississippi, for training; DOC/NWS has one each at the National Reconditioning Center, and NWS Training Center in Kansas City, Missouri and at the Operational Support Facility, Oklahoma City, Oklahoma.

AUTOMATED SURFACE OBSERVING SYSTEM (ASOS). The ASOS program began in 1983, as a joint development effort between the DOC, DOD, and DOT/FAA. Installation of ASOS units started in 1992. A total of 1002 units have been purchased. The NWS has purchased, accepted, and commissioned 313 sites. The FAA has purchased 570 units, all of which have been accepted and commissioned by the NWS. The Navy has purchased and accepted 72 sites. The Air Force has purchased and accepted 47 sites. Collectively, a total of 1002 ASOS sites have been commissioned.

AUTOMATED WEATHER INFORMATION SYSTEMS (AWIS). The DOC, DOD, and DOT require AWISs to facilitate the collection, pro-

cessing, and interpretation of meteorological data. AWISs are being procured to provide an automated, high-speed, user-friendly man/machine interface to access and process large volumes of sophisticated meteorological data. AWIS supports timely production of accurate and geographically precise warnings, forecasts, and specially tailored products while including a communications capability to facilitate expeditious dissemination.

Major agency systems classified as AWISs are: NOAA's Advanced Weather Interactive Processing System (AWIPS), FAA's Weather and Radar Processor (WARP), Air Force's Joint Environmental Toolkit (JET), and the Navy's Naval Integrated Tactical Environmental Subsystem (NITES).

AWIPS: In February 1997, the Secretary of Commerce approved the limited deployment of AWIPS at over forty sites. On April 9, 1998, the Secretary authorized full scale production and deployment of AWIPS, through Build 4.2, for the remaining 95 systems. Installation of these 95 systems began in September 1998 and was completed in June 1999. An Operational Test and Evaluation of the commissioning software load (Release 4.2) was successfully conducted from mid-May through June 1999. AWIPS commissioning began in January 2000 and, currently the NWS has commissioned all 139 operational AWIPS systems located at 122 Weather Forecast Offices (WFOs), 13 River Forecast Centers (RFCs), the Spaceflight Meteorology Group (SMG), and 4 National Centers for Environmental Prediction (NCEP).

The NWS successfully completed the final development phase release of AWIPS (Build 5) in early 2003, completed deployment of its first Operational Build (OB1) that summer, and completed deployment of Operational Build 2 (OB2) in December 2003. Installation of Operational Build 3 (OB3) is sched-

uled for completion in summer 2004. First installation of Operational Build 4 (OB4) is planned to take place in the middle of FY05. Of note within the operational builds of AWIPS is an evolution of the architecture to the Linux open source operating environment which was started during the Build 5 phase and will continue through to its planned completion in early 2007.

WARP: The FAA's WARP will greatly enhance the dissemination of aviation weather information throughout the National Airspace System (NAS). WARP automatically creates unique, regional, WSR-88D-based, mosaic products, and sends these products, along with other time-critical weather information, to controllers through the Display System Replacement and to pilots via the FIS. WARP underwent operational testing and evaluation in early FY 2003 and is operationally fielded at the 21 ARTCCs and the command center. Others systems used for enhancements, testing, and software support bring the total to 25 systems.

JET: The Air Force is modernizing and improving strategic, operational, and tactical-level systems; a key component of which is the JET. JET will replace several disparate legacy weather systems with a single, integrated means of supporting both garrison and deployed operations, including a "first-in" combat weather forecast capability. Combining forecasting, product-tailoring, and mission-impact capabilities in an interactive, network-centric, standards-based package; JET accesses, processes, analyzes, tailors, and disseminates terrestrial and space weather products to guide warfighter decision-making. This effort will eliminate Air Force Weather Weapon System (AFWWS) redundancies and inefficiencies, reduce the burden on system administrators, and ultimately extend, consolidate, or replace the following systems: Operational Weather Squadron (OWS) Production System

Phase II (OPS II), the New-Tactical Forecast System (N-TFS), the Joint Weather Impacts System (JWIS), and the Army's Integrated Meteorological System (IMETS) weather toolkit.

NITES: The Navy continued migration towards a modular, interoperable suite of systems to ingest, process, fuse, display, and disseminate METOC information and its impact on tactical operations. The current program consists of four seamless versions known as NITES Versions I-IV. NITES will be fielded through FY 2006. The NITES Version II Object Oriented Redesign (OOR) is the basis for the Joint METOC Segment of the new Global Command and Control System (GCCS) V4.0. Navy is reviewing options to field a follow-on system to NITES that would support naval tactical operations and be interoperable with the other services.

NATIONAL POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITE SYSTEM (NPOESS)

The NPOESS Program began when Presidential Decision Directive (PDD) NSTC-2 established the Integrated Program Office (IPO) in October 1994. Under the terms of this PDD, the IPO's function is to "...reduce the cost of acquiring and operating polar-orbiting environmental satellite systems, while continuing to satisfy United States DOD (Department of Defense) and DOC (Department of Commerce) operational requirements for data from these systems." Effectively, the directive combines the current operations and future follow-on activities of the DOD Defense Meteorological Satellite Program (DMSP) with the DOC National Oceanic and Atmospheric Administration (NOAA) Polar-orbiting Operational Environmental Satellite (POES) program. The new follow-on system is called NPOESS, and will be available to launch after the failure of the last operational DMSP or POES satellite, around 2010. Cooperation

with foreign governments and international organizations is being nurtured.

NPOESS is an integrated DOC, DOD, and National Aeronautics and Space Administration (NASA) program. Through the IPO, DOC is responsible for operations and overall program management; DOD contracts are used for the acquisition of the satellites, launch vehicles, and associated ground systems; and NASA is responsible for insertion of new and innovative technologies.

The space segment of NPOESS will include space platforms and sensors that will collect and store environmental and other data. This data will be downlinked to a network of receptor sites around the world, which will immediately forward data via fiber optic communications to the Operational Weather Processing Centers (i.e. AFWA, FNMOC, NAVO, and NESDIS). This innovative data distribution scheme is projected to be at least 3 times faster than the required data latency of 90 minutes. The satellite will also provide continuous downlink of data to Field Terminals used by deployed/remote military units and civilian users to obtain environmental data. The space segment will consist of meteorological, oceanographic, terrestrial, space environmental monitoring, and climatic sensors, in addition to other systems such as surface data collection/location and search and rescue.

The NPOESS constellation will notionally consist of three satellites, which will fly at 833 ± 17 kilometers altitude with an inclination of 98.7 ± 0.05 degrees in three distinct sun-synchronous orbits; early morning, midmorning, and early afternoon. A wide variety of sensors will be carried aboard these platforms to acquire imagery and other meteorological and environmental data.

Each satellite will carry several types of sensors to accomplish its mission: electrical/optical (E/O), microwave (MW), space environmental, and other

specialized sensors. The E/O instruments include a Visible/Infrared Imager/Radiometer Suite (VIIRS) to provide imagery in the VIS and IR spectra, a Cross-track Infrared Sounder (CrIS), a passive IR sounder to provide high-resolution vertical profiles of atmospheric properties in conjunction with MW soundings, and an Ozone Mapping and Profiler Suite (OMPS) to measure ozone in the Earth's atmosphere. The microwave instruments include a NASA developed Advanced Technology Microwave Sounder (ATMS) to measure atmospheric temperature and water vapor profiles and a separate Conical Scanning Microwave Imager Sounder (CMIS), consisting of an imager and a supporting sounder, to measure the critical surface and atmospheric phenomena in the MW spectrum under "all weather" conditions. The space environmental sensor suite (SESS) will measure parameters such as electron density profiles, neutral density profiles, and charged particle energies. Other NPOESS instruments include NASA's Total Solar Irradiance Sensor (TSIS) to measure solar energy per unit time per unit area, and the Aerosol Polarimetry Sensor (APS) to retrieve specified aerosol and cloud parameters using multispectral photopolarimetry.

NPOESS will carry other payloads that are similar to existing instruments, such as the French-provided Data Collection System (DCS), which collects and processes measurements from buoys, free-floating balloons, and remote weather stations, for on-board storage and subsequent transmission from the satellite, and the joint Canadian/French Search and Rescue Satellite Aided Tracking (SARSAT) system that uses NOAA satellites in low-Earth and geostationary orbits to detect and locate aviators, mariners, and land-based users in distress. The satellites relay distress signals from emergency beacons to a network of ground stations and ultimately to the

United States Mission Control Center (USMCC) in Suitland, Maryland. The USMCC processes the data and alerts the appropriate search and rescue authorities.

Additionally, NPOESS will carry sensors such as the NASA Earth Radiation Budget Sensor and an altimeter. One of the CMIS missions is to use its polarimetric data to measure the ocean surface wind speed and direction, producing data that is comparable to the Advanced Scatterometer (ASCAT) being flown on EUMETSAT's Metop for ocean measurements (i.e. surface stress, surface wind, sea ice coverage).

FY 2003 was a very full year for NPOESS. The most significant activity of the year was the award of the contract to TRW (now Northrup Grumman Space Technology (NGST)) at the end of FY 2002. Northrop is the prime contractor for the entire system, teamed with Raytheon to provide the Ground Segment portion. During FY 2003, the major focus was on completion of the VIIRS, CrIS, OMPS instruments and the command and control and data processing systems, all slated for first use on the joint IPO/NASA NPOESS Preparatory Project (NPP) satellite, slated for launch in the fall 2006.

In FY 2000, NASA and NOAA established the Joint Center for Satellite Data Assimilation (JCSDA) to facilitate the use of satellite environmental data by developing new and powerful mathematical techniques to assimilate the data into numerical weather prediction (NWP) models. The NPOESS program arranged for the DOD to participate in this effort, and the IPO is augmenting the JCSDA with funding to ensure NPOESS data is quickly accelerated into weather operations once it begins flowing.

In FY 2003 and early 2004, the NPOESS IPO and NASA completed arrangements with the Kingdom of Norway for installation of satellite C3 antennae on the island of Svalbard and

fiber optic communications between the island and the Norwegian mainland. This provides redundant, reliable high volume communications for command and control and data retrieval. The site became operational in January 2004 and began taking data passes from the Navy's Coriolis/Windsat wind measurement satellite.

NPOESS also recently sponsored UCAR's (University Consortium for Atmospheric Research) Cooperative Program for Operational Meteorology, Education and Training (COMET) in branching into high-latitude territory. Since the usefulness of geostationary satellites declines rapidly at latitudes above 60° north and south, NPOESS data are especially important toward the poles. COMET is developing a training series to orient forecasters to the products available from the polar orbiters. COMET is also developing material to help prepare forecasters for the data provided by the NPOESS series satellites.

The IPO is working with the NGST/Raytheon team on a daily basis to ensure ground systems are in place and operating in time for an NPOESS Preparatory Project (NPP) launch in the late 2006 timeframe and that all systems are ready for an expected 2010 NPOESS launch. In addition to DMSP and POES activities at NOAA's Satellite Operations Control Center (SOCC) in Suitland, Maryland, the operational side of the IPO will get busier with the additional responsibilities of WindSat Coriolis, NPP, and NPOESS over the next several years.

More information regarding the NPOESS program can be found at npoess.noaa.gov.

OTHER AGENCY PROGRAMS

For FY 2005, the Department of Agriculture (USDA) requested \$39.5 million for meteorological operations and supporting research. Operationally, the USDA supports specialized weather observation networks

and also conducts an active supporting research program to ensure an abundance of high-quality agricultural commodities while minimizing the adverse effects of agriculture on the environment. Under supporting research, USDA focuses on the interactions of weather and climate with plant and animal production and water resources management.

The Department of the Interior's (DOI) FY 2005 request of \$2.4 million is primarily to support the Bureau of Land Management's Remote Automatic Weather Station (RAWS) program.

The budget request for the Environmental Protection Agency (EPA) is \$9.0 million, a slight increase over FY 2004, to provide user-appropriate and scientifically credible air-quality meteorological programs to support regulatory applications. The increase reflects the increased interest on the effects of global climate change on regional air quality, air quality forecasting, and the effects of air quality changes on human health.

NASA requests a total of \$247.6 million--\$2.5 million for operations and \$245.1 million for supporting research. These funding levels are composed of the estimated meteorology share of the supporting research and analysis programs as well as Earth Observing System (EOS) and Earth Probe instruments, EOS science, and the EOS Data Information System elements of the NASA Office of Earth Science budget. Included in NASA's request is \$71.3 million for special programs under the category of aviation weather supporting research.

The Nuclear Regulatory Commission's (NRC's) request for \$120,000 in FY 2005 is for operations. The NRC will dedicate these funds to obtain and analyze meteorological data and information related to siting new nuclear power plants and safe operation of nuclear facilities, to the protection of public health and safety, and protection of the environment.

FEDERAL COORDINATION

INTERDEPARTMENTAL HURRICANE CONFERENCE. OFCM annually hosts the Interdepartmental Hurricane Conference (IHC) to provide a forum for the responsible Federal agencies, together with representatives of the user communities such as emergency management, to review the Nation's hurricane forecast and warning program and to make recommendations on how to improve the program in the future. OFCM conducted the 58th Interdepartmental Hurricane Conference (IHC) in Charleston, South Carolina, March 1-5, 2004. The theme of the conference was *Hugo to Isabel: 15 Years of Progress Plus Momentum for the Future*. The conference attendance was 216; for the fifth consecutive year, attendance has exceeded 200. The principal objectives of the conference were to: review the Nation's hurricane warning program, highlighting both the advances made since Hurricane Hugo and future challenges; evaluate lessons learned from the 2003 hurricane season, with a focus on Hurricane Isabel, and update the *National Hurricane Operations Plan* for 2004; examine the impacts of tropical cyclone hazards, such as storm surge, and begin to assess the socioeconomic/cost avoidance aspects of tropical cyclone forecasts and warnings; evaluate the Joint Hurricane Testbed (JHT) as a model for transitioning successful research results into operations; and develop the framework for a comprehensive R&D plan which documents and prioritizes research needs based on operational needs and requirements. The keynote address was presented by the Honorable Michael D. Brown, Undersecretary for Emergency Preparedness and Response, Department of Homeland Security. He praised the support provided by NOAA and the Federal meteorological community as instrumental in minimizing the loss of life and damage to

property each year from hurricanes and other tropical storms. In May 2004, the OFCM published the 42nd edition of the *National Hurricane Operations Plan* (NHOP), which documents the new procedures, procedural changes, and agreements reached at the IHC.

Several major accomplishments that have resulted from specific action items that were brought to the IHC or have been achieved through the partnership arrangements facilitated by the IHC include: implementation of the 5-day hurricane forecast; development of the Stepped Frequency Microwave Radiometer (SFMR); improved capability because of use of Global Positioning System dropwindsondes; improved hurricane modeling and prediction; increased focus on inland flooding; the successful partnering with the Federal Emergency Management Agency through the Hurricane Liaison Team; improved preparedness, response and outreach to the public through Hurricane Awareness Week; support to the Joint Hurricane Testbed; partnership between IHC and The Weather Channel; and increased outreach to other Federal agencies. A key action item from this year's IHC is preparation of a comprehensive hurricane R&D plan to document and prioritize research needs based on operational needs and requirements. Use of SFMR surface winds had an immediate impact on analyses for Hurricane Frances in September 2004. The SFMR surface winds showed that the radius of 34 knot and 50 knot winds had increased from the previous observations by a significant amount, necessitating the extension of warnings further north along the Florida east coast. Further, analysis of the SFMR data showed that, while the peak eyewall winds had not increased, a shift in the hurricane force winds occurred from east of center at the previous analysis time 6 hours earlier to north and northwest of the center; i.e., toward the

landward side of Frances. This OFCM-sponsored development effort is beginning to pay big dividends. The next task is to transition the SFMR technology to the operational fleet of WC-130J aircraft flown by the Air Force Reserve Command's 53rd Weather Reconnaissance Squadron-the Hurricane Hunters.

USER FORUM ON URBAN METEOROLOGY.

OFCM, in partnership with the Department of Homeland Security (DHS) Science and Technology Directorate, conducted a User Forum on Urban Meteorology September 21-23, 2004, at the Doubletree Hotel and Executive Meeting Center in Rockville, Maryland. The theme of the forum was *Information to Improve Community Responses to Urban Atmospheric Hazards, Weather Events, and Climate*. It focused on the following elements of urban meteorology: severe weather, homeland security, air quality, water quality, and climate. This interagency forum was the direct result of an action item from the October 18, 2002, meeting of the FCMSSR and, also, follows from the 7th Annual George Mason University (GMU) Transport and Dispersion Modeling Conference (June 17-18, 2003) and the 8th Annual GMU Conference (July 13-15, 2004). The forum's agenda included key presentations at the beginning and end of the forum, five plenary session panels, and six workshop sessions scheduled in pairs. The forum's objectives were to: reduce high impact weather and climate risks and improve the quality of life in urban areas; increase understanding and facilitate the transfer of emerging science and technology to meet today's urban weather and climate challenges; improve forecasting in coastal areas and areas with complex terrain; and set the stage for building user-tailored decision support systems for real-time response to the spectrum of hazardous weather events and

atmospheric conditions. The subject of this forum is extremely important since nearly two-thirds of the U.S. population lives in urban areas occupying less than two percent of the U.S. landmass, and America's vulnerability to severe weather and hazards related to air quality, water quality, atmospheric dispersion of dangerous materials, and climatic variations are rising as the urban proportion of the population increases. The User Forum on Urban Meteorology supports NOAA's goals related to coastal and ocean resources, climate, weather and water information, homeland security, and commerce.

OPERATIONAL PROCESSING.

The spring 2004 meeting of the OFCM Committee for Operational Processing Centers (COPC) took place at the Air Force Weather Agency in Omaha, Nebraska, from March 31-April 1, 2004. The focus of the meeting was on the Weather Research and Forecasting (WRF) community model and how to facilitate the exchange of data and information among the WRF Operational Test Centers (OTC). The major goals and issues of the meeting dealt with information technology collaboration, grid computing, and architectural issues; establishment of priorities for the Joint Action Group for Operational Community Modeling (JAG/OCM); the WRF Concept of Operations; WRF Operational Test Center procedures; and a combined strategy for future year budget requests. The major accomplishment of the meeting was finalizing and signing on April 1, 2004, of the *National Concept of Operations Framework for the Operational Processing Centers* to guide the implementation of WRF--the next-generation numerical weather prediction model. Another significant accomplishment was the publication of the *Catastrophic Backup Action Plan* (CBAP) for the operational processing centers (OPC) in July 2004. The purpose of the CBAP is to identify catastrophic backup shortfalls that exist at

the Nation's military and civilian meteorological, oceanographic, and satellite OPCs that can be addressed in the short term. With respect to the plan, "catastrophic" means a total incapacitation of an OPC for an extended period of time. "Short term" means months--that which can be accomplished with a minimum of already available resources. The CBAP identified 10 shortfalls. Plans to address each of the shortfalls have been developed. For six of the shortfalls, implementation activities have been accomplished. That is, the tasks needed to establish backup capabilities are finished and the resources needed to establish backup capabilities are available. COPC activities relate to the crosscutting area of homeland security in addition to NOAA's goal to serve society's needs for weather and water information.

ENVIRONMENTAL SUPPORT TO HOMELAND SECURITY.

George Mason University Transport and Dispersion Modeling Conference. George Mason University (GMU), Fairfax, Virginia, conducted its 8th Annual Conference on Transport and Dispersion Modeling, July 13-15, 2004. The OFCM partnered with the Defense Threat Reduction Agency (DTRA) and GMU to sponsor the event. The major topic areas for the conference were: new developments in basic theories of boundary layer models and transport and dispersion models; urban-scale meteorological and dispersion experiments and models; computational fluid dynamics (CFD) model theory and applications; field experiments and laboratory experiments concerned with boundary layer studies and turbulence and dispersion studies; mesoscale meteorological modeling for input to transport and dispersion models; the use of remote sensing technology in boundary layer and transport and dispersion studies; model evaluation methods, uncertainty/sensitivity analy-

ses, and risk assessments; improvements in model inputs (e.g., land-use data, 3-D building data) and output visualizations; and methods and criteria for emergency response and decision-making. There was also a special session on the Joint Urban 2003 Field Experiment, the DTRA/DOE-sponsored Oklahoma City Field Exercise which occurred in Oklahoma City from June 28 - July 31, 2003.

On July 14, 2004, OFCM hosted a session related to OFCM's ongoing work with the Department of Homeland Security and other members of the Federal meteorological community to define the concept of operations and the research and development needs required to support the National Incident Management System and emergency responders at Federal, state, and local levels. The objectives of the OFCM session were twofold: (1) to inform attendees regarding the Interagency Modeling and Atmospheric Assessment Center (IMAAC) and the role the Federal agencies will play in the development of the IMAAC, and (2) to present the draft Federal ATD R&D Plan, *Federal Research and Development Needs and Priorities for Atmospheric Transport and Diffusion Modeling*, and solicit comments, feedback, and discussion from the conference attendees. The OFCM session included two invited presentations and a panel discussion. As follow-on actions, the OFCM will continue to work with the Department of Homeland Security/Science and Technology Directorate (DHS/S&T) to develop the implementation plan and concept of operations for the IMAAC, integrating the responsibilities and capabilities that all the Federal agencies bring to the table. The Federal ATD R&D Plan will be presented to the Interdepartmental Committee for Meteorological Services and Supporting Research (ICMSSR) for approval in the fall, following the presentation to the OFCM/DHS jointly

sponsored Urban Meteorology User Forum, which will be conducted September 21-23, 2004, to provide the private and academic sectors an opportunity to further discuss with members of the public sector the Federal research and development needs and priorities for atmospheric transport and diffusion modeling.

Homeland Security Environmental Support Plan. Work is ongoing to complete the interagency *Homeland Security Environmental Support Plan*--an action from the FCMSSR. The plan defines the mission, roles, and responsibilities of individual Federal agencies as they relate to homeland security and documents each agency's environmental support capabilities and/or requirements. The OFCM is currently working closely with the Plume Modeling Subset of the Consequence Management, Site Restoration/Cleanup Subgroup, which is chaired by the Department of Homeland Security (Emergency Preparedness and Response), to develop an interagency concept of operations for an all-hazards dispersion support framework. The concept of the Interagency Modeling and Atmospheric Assessment Center (IMAAC) was successfully proposed to the Homeland Security Council Deputies in April 2004. The Department of Homeland Security/Science and Technology Directorate (DHS/S&T) then started developing the IMAAC implementation plan and concept of operations in partnership with DOD, DOE, EPA, NOAA, NRC, NASA, and OFCM. Once it evolves, the concept of operations for the IMAAC will be an integral part of the *Homeland Security Environmental Support Plan*, which should be ready for publication in fall 2004. The intended audience for this document includes the Federal agencies involved in crisis and consequence management, and state and local (e.g., city, county, and parish) governments and their first-responder organizations.

Federal Atmospheric Transport and Diffusion Research and Development Plan. An interagency joint action group (JAG) was formed and activity is underway to develop an integrated research and development plan to support the atmospheric transport and diffusion modeling needs and activities of the Federal agencies in support of the Department of Homeland Security--an action from the FCMSSR. The plan will identify the research and technical needs required to enhance Federal atmospheric transport and diffusion (ATD) modeling. Input to the plan will include: *Atmospheric Modeling of Releases from Weapons of Mass Destruction--Response by Federal Agencies in Support of Homeland Security* (OFCM); *Tracking and Predicting Atmospheric Dispersion of Hazardous Material Releases, Implications for Homeland Security* (NRC); and the OFCM special sessions of the 7th Annual GMU Conference on Transport and Dispersion Modeling (June 2003) and 8th Annual GMU Conference (July 2004). The JAG conducted a gap analysis and consulted with subject-matter experts; listed and prioritized R&D needs; developed research and advanced development strategies; and developed a framework for transitioning successful research results into operations through interagency cooperative efforts like observational and modeling test beds, field and urban studies/experiments, and a common model evaluation methodology. The plan prioritizes the most pressing needs based on stated operational shortfalls and provides a roadmap to address those needs within the OFCM coordinating infrastructure. As discussed above, the initial draft plan was vetted through the 8th Annual GMU Transport and Dispersion Modeling Conference in July 2004. Then following the presentation to the September 2004 Urban Meteorology Forum, the plan will be presented to the ICMSSR in

the fall for its responses and actions to the recommendations. The expected completion date is October 2004.

WEATHER INFORMATION FOR SURFACE TRANSPORTATION.

OFCM published the *Weather Information for Surface Transportation-National Needs Assessment Report* in December 2002. The WIST Report sets the stage for revolutionary improvement in the way weather information is applied to surface transportation across the Nation. It establishes a process that involves decision makers throughout the public and private sectors, academia, and industry in a collaborative effort to define weather information needs and recommends next steps to incorporate current and future results from science and technology innovations into surface transportation activities that bear on the safety and economic welfare of all citizens. The WIST Report is the product of an extensive 3-year interagency effort and is a historic achievement from the standpoint that it is the first-ever compilation of weather support needs across the six surface transportation sectors: roadway, railway, transit, marine transportation, pipeline systems, and airport ground operations. This activity included the formation of a joint action group to address meteorological requirements for surface transportation; questionnaires; surveys; WIST symposia conducted jointly by the Office of the Federal Coordinator for Meteorology and the Federal Highway Administration; meetings with railroad, pipeline, and emergency managers; and participation on panels concerning public-private partnerships in transportation and Intelligent Transportation Systems. The report makes clear that by meeting the requirements for provision of weather information for surface transportation to users, we can often increase safety and realize economic benefits at the same time.

The *Weather Information for Surface Transportation-National Needs Assessment Report* has led to a great deal of activity in this new and important area of meteorological support.

- On August 18, 2003, Ms. Mary E. Peters, Administrator of the Department of Transportation/Federal Highway Administration (FHWA), and VADM Conrad C. Lautenbacher, Jr., USN (Ret.), Under Secretary of Commerce for Oceans and Atmosphere and Administrator of the National Oceanic and Atmospheric Administration (NOAA), met to begin a dialog regarding the next steps to take in the area of Weather Information for Surface Transportation (WIST). Ms. Peters indicated that the WIST Report documented not just FHWA needs, but all of DOT's requirements, and she wanted to begin discussions with NOAA senior leadership on how NOAA and FHWA could work together to meet those needs and requirements. The FHWA's first concern is enhancing roadway safety, followed by improving efficient transportation regardless of the weather conditions experienced by surface transportation operators. Weather is a major economic factor. At least \$1 trillion of our economy is weather-sensitive, as goods and services move through our Nation's transportation systems.

- Subsequently, OFCM hosted a NOAA-FHWA meeting on October 24, 2003, to discuss strategy and plans for near-term, intermediate-term, and long-term activities for WIST.

- OFCM worked with AMS senior leadership to help structure the AMS Policy Forum on "Highways and Weather" held on November 4-5, 2003, where the Federal Coordinator played a key speaking role to set the tone and direction of the forum.

- OFCM provided VADM Lautenbacher a status report on November 6, 2003, concerning NOAA and FHWA staff activities to meet the WIST-related tasks laid out during the

August 18, 2003, NOAA-FHWA meeting.

- NOAA senior leadership supported the incorporation of WIST as a program element under NOAA Strategic Plan Goal #4 (Commerce and Transportation) on November 17, 2003, by issuing guidance that the NOAA Commerce and Transportation Program Plan should support and be "consistent with Weather Information for Surface Transportation (WIST) demonstration and pilot projects."

- OFCM made several, specific inputs to the NOAA Strategic Plan Goal Team #4's R&D proposal (NOAA Research and Development Plan For Safe and Efficient Surface Transportation) developed in late November and early December 2003, in support of the NOAA leadership guidance to include WIST in the Commerce and Transportation Program Plan. This proposal was approved by the Deputy Under Secretary of Commerce for Oceans and Atmosphere.

- OFCM provided a foundation-laying WIST briefing to the National Academy of Sciences' Board on Atmospheric Sciences and Climate (BASC) and Transportation Research Board (TRB) as they began to develop the report *Where the Weather Meets the Road--A Research Agenda for Improving Road Weather Services*, which was released on January 16, 2004. The BASC report endorses the WIST Report results and calls for the Federal government to establish a multiyear national road weather research program, led by the FHWA, to bring together the weather and surface transportation research communities. The report also calls for the development of an overarching, multiagency-coordinated WIST implementation program.

- Another NOAA-FHWA WIST meeting was held February 19, 2004. The purpose of the meeting was to further discuss and develop a detailed, proposed set of near-term pilot projects that would help NOAA and FHWA

begin to implement the WIST Report recommendations in the operational and research areas and document results of these joint efforts.

- OFCM participated in the AMS 2004 Corporate Forum which was held March 14-16, 2004. The forum focused on the themes of earth observations, public-private-academic partnerships in the weather and climate enterprise, and road weather. The Federal Coordinator briefed the Corporate Forum on *The WIST Report and the Road Ahead*.

- OFCM participated in the AMS and National Academies Congressional Briefing, *Weather and Our Nation's Roads: The Need for a Coordinated Road Weather Research Program*, March 17, 2004. Topics discussed included application of weather information to road safety and efficiency, a research agenda for improving road weather services, and perspectives from the state and local level.

- NOAA and FHWA personnel also met on March 19, March 25, March 30, and April 9, 2004, to work on a NOAA/FHWA Partnering Plan to lay the groundwork to achieve their shared goals for a safer and more efficient surface transportation system. The first iteration of the Partnership Plan groups initiatives into five categories: Training, Observations, Numerical Weather Prediction, Databases/Decision Support, and Information Dissemination.

- Weather Information for Surface Transportation was briefed and discussed at the May 14, 2004, meeting of the ICMSSR. Actions which came out of the ICMSSR meeting include: (1) Complete development of the NOAA/FHWA Partnering Plan, covering road weather needs, as a first step in showing progress on WIST needs; (2) OFCM establish a Working Group for WIST (WG/WIST), led by FHWA and NOAA, to allow all Federal departments and agencies to participate in the development of plans or

projects to meet their WIST needs and ensure Federal resources are used efficiently; (3) WG/WIST develop a multiyear, Federal WIST research program plan to bring together the Federal weather and surface transportation research communities and provide a vision for the public and private sectors to use for planning purposes; and (4) WG/WIST develop an overarching, Federal, multiagency-coordinated WIST implementation program.

- OFCM participated in the 1st Surface Transportation Weather Workshop at the University of North Dakota, August 11-12, 2004. The workshop was cosponsored by the University of North Dakota Surface Transportation Weather Research Center and FHWA. A senior OFCM staff person addressed the workshop during its session on *Converting a National Vision into Reality*.

- An ad hoc WIST Executive group met on August 26, 2004, to review progress on the NOAA-FHWA Partnering Plan, a draft NOAA-FHWA Memorandum of Understanding, and to receive an activities update briefing from NOAA's Surface Weather Program Manager. It was discussed that the NOAA-FHWA Partnering Plan should be restructured to concentrate on "NOAA's responsibility for protecting life and property and enhancing the national economy. The NOAA Surface Weather Program should stress its support of public safety, and its commitment to support the Nation's commerce with information for safe, efficient, and environmentally sound transportation (NOAA's Commerce and Transportation Strategic Goal)."

AVIATION WEATHER.

In December 2003, OFCM issued an update to the *2001 Aviation Weather Program Baseline Report*. This is part of the continued implementation of the *National Aviation Weather Program Strategic Plan* and the *National Aviation Weather Initiatives*. The update is an inventory of over 150 pro-

grams/projects in aviation weather and represents nearly a doubling of the number of programs/projects in the 2001 report; a preliminary summary of the inventory was included in the *National Aviation Weather Program Mid-Course Assessment* which was published in August 2003. The update is a snapshot of work underway in both the Federal agencies and the private sector and includes a mapping of the programs/projects against the National Aviation Weather Initiatives. The update shows that most of the initiatives are being worked by one or more agency programs, but it also cautions that the agencies must remain vigilant for possible duplication. Furthermore, the programs/projects outlined represent a fairly complete inventory of work being done in the aviation community to reduce accidents and delays where weather is a contributing factor. Accident statistics are showing that fatal accident rates involving weather are declining, and it is believed that the R&D efforts, as well as the other work highlighted in this updated report, are contributing to this decrease. OFCM conducted a Panel Session on the National Aviation Weather Initiatives at the National Business Aviation Association, Inc. and Friends and Partners in Aviation Weather Annual Meeting held in Orlando, Florida, in October 2003, and provided an update on implementation of the National Aviation Weather Program at the National Weather Association 28th Annual Meeting in Jacksonville, Florida, October 18-23, 2003.

From June 21-24, 2004, the OFCM hosted the *2nd International Conference on Volcanic Ash and Aviation Safety* at the Hilton Alexandria Mark Center Hotel, Alexandria, Virginia. The theme of the conference was *Avoiding Airborne Volcanic Ash--Anywhere in the World*, and its overall goal was to enhance mitigation capabilities worldwide by providing an international forum for

the exchange of technical, operational, and scientific information. Attendees represented airlines (meteorology departments, dispatch, pilots), aviation manufacturers, airport authorities, governmental and nongovernmental organizations, volcano observatories, Volcanic Ash Advisory Centers, academia, and the scientific press. Total conference attendance was 226 persons; 21 nations and 15 airlines were represented. The conference was very successful. Information collected from conference attendees will ensure that the four conference expectations will be achieved. These are (1) identify new operational needs/requirements and the research and development needed to satisfy those requirements, (2) where possible, match operational and research and development needs/requirements to ongoing programs/projects to maximize partnership efforts, (3) develop a roadmap for improved volcanic ash-related education, training, outreach, and decision tools, and (4) develop a framework for improved partnerships within the international volcanic ash community to leverage resources and capabilities across the spectrum of operations and research and development. The conference generated a number of action items and recommendations which the OFCM Working Group for Volcanic Ash (WG/VA) was tasked to address. Specifically, the WG/VA will (1) seek further help, input and advice from international partners and the International Civil Aviation Organization; (2) sort action items and recommendations into short- (0-12 month), mid- (1-4 year), and long-term (4-10 year) actions and prioritize them; and (3) develop and gain approval of a Volcanic Ash Implementation Plan. The plan will detail program goals; operational needs/requirements; R&D needs and priorities; a roadmap for improved volcanic ash-related education, training, outreach, and decision tools; and a framework for improved

partnerships within the international volcanic ash community to leverage resources and capabilities across the spectrum of operations and research and development within the next 12 months. A summary of the conference outcomes was issued in July 2004. One example, and a timely reminder, of why the Volcanic Ash Conference is so relevant, is the seismic activity and releases of steam and volcanic ash from Mount St. Helens in Washington beginning September 23, 2004, and the possibility of a blast of ash that will rise tens of thousands of feet and drift with the wind.

SPACE WEATHER.

Space weather refers to conditions on the Sun and in the solar wind, magnetosphere, ionosphere, and thermosphere that can influence the performance and reliability of space-borne and ground-based technological systems, and can endanger human life or health. Space weather storms can cause disruption of satellites, communications, navigation, and electric power distribution grids. The overarching goal of the National Space Weather Program (NSWP), which is administered by an OFCM program council, is to achieve an active, synergistic, interagency system to provide timely, accurate, and reliable space weather warnings, observations, specifications, and forecasts by 2007. The NSWP Strategic and Implementation Plans provide, respectively, broad guidance and a detailed roadmap for the NSWP.

In the first quarter of FY04, OFCM led the development of a report on the *Importance of the National Oceanic and Atmospheric Administration's Space Environment Center (NOAA/SEC) to the National Space Weather Program (NSWP)*, in response to continuing Congressional budget pressures being experienced by NOAA/SEC and concerns expressed by the NSWPC and the CSW. The report outlined the many key benefits provided by NOAA/SEC to the multi-

agency NSWP. The report also detailed the negative impacts that would result from insufficient funding at SEC with regard to the Nation's ability to observe, predict, and warn of impending solar activity and the resultant impacts on the Nation's technical systems and human life or health. This report was endorsed to the Office of Science and Technology Policy (OSTP) by the Under Secretary and FCMSSR Chairman. In November 2003, in a message from OSTP to Congressional staff, Dr. John H. Marburger, III, OSTP Director, supported the full funding of SEC. While not totally successful, this effort did garner enough Congressional support to fund NOAA/SEC in FY04 at 65 percent of their budget request.

OFCM took part in Space Weather Week at NOAA's Space Environment Center, Boulder, Colorado, April 13-16, 2004. The conference highlighted recent space weather impacts in several areas of the environment, including airline problems, GPS and ionospheric disturbances, satellite drag, and geomagnetic storms.

Work is underway to conduct the next meeting of the Committee for Space Weather (CSW) in October 2004 and planning has begun for the next meeting of the National Space Weather Program Council.

PHASED ARRAY WEATHER RADAR PROJECT.

OFCM hosted a Phased Array Weather Radar Project (PAWRP) meeting on July 22, 2003, attended by six Federal departments and agencies to explore expanded agency participation in the project. This meeting was held in response to actions of the last meeting of the FCMSSR (October 18, 2002) and the ICMSSR (April 30, 2003). The FCMSSR and ICMSSR directed the Federal Coordinator to determine specific needs of the agencies, show benefits of the Phased Array Radar (PAR) capability for their respective agencies, and explore opportunities for

expanded agency participation in the PAWRP.

OFCM arranged for a January 29, 2004, visit to the National Severe Storms Laboratory (NSSL) by representatives from three Federal agencies to learn more about PAR technology and how it might benefit their organizations. NSSL has a phased array radar provided by the Navy for research purposes. The participants were briefed on PAR technology, and the resultant discussion answered agency questions concerning how the PAR technology might meet agency requirements, what period of time might be needed for the required PAR R&D to be accomplished before an operational system could be developed and fielded, and what other advancements (e.g., improved data assimilation, improved forecast models) would be needed in addition a PAR system to go from "warn on detection" to "warn on forecast and detection." It was also briefed that the PAR will be ready for R&D efforts beginning March 2004. Additionally, based on knowledge gained at the July 2003 meeting, and a subsequent visit to NSSL in January 2004, OFCM will begin work with the Federal agencies to form a Joint Action Group that would identify the potential needs and benefits of the agencies that PAR and Networked Radars (NETRAD) would address, develop a PAR R&D plan that would focus R&D efforts on meeting agency needs, and developing a funding proposal to support the required PAR R&D.

The PAWRP was briefed and discussed at the May 14, 2004, meeting of the ICMSSR. Actions which came out of the ICMSSR meeting include: (1) OFCM work with the Federal agencies to form a Joint Action Group for Phased Array Weather Radar Project (JAG/PAWRP) of stakeholder agencies; (2) JAG/PAWRP identify and document the potential needs and benefits of the agencies that phased array radar and an adaptive radar sensing

strategy would address; and (3) JAG/PAWRP integrate those identified needs into a multiagency coordinated R&D plan that would focus efforts on meeting agency needs.

PUBLICATIONS AND OFCM'S WEB SITE.

The following publications were prepared in hardcopy form and/or have been placed on OFCM's Web site (www.ofcm.gov):

- *The Federal Plan for Meteorological Services and Supporting Research-Fiscal Year 2004*
- *Aviation Weather Programs/Projects (Tier 3/4 Baseline Update)*
- *Urban Meteorology-Meeting Weather Needs in the Urban Community*
- *National Hurricane Operations Plan*
- *Federal Meteorological Handbook No. 11-Doppler Radar Meteorological Observations; Part A-System Concepts, Responsibilities and Procedures*

• *Catastrophic Backup Action Plan*

The following documents are planned for publication during FY 2005:

- *The Federal Plan for Meteorological Services and Supporting Research-Fiscal Year 2005*
- *Federal Atmospheric Transport and Diffusion Research and Development Plan*
- *Homeland Security Environmental Support Plan*
- *Proceedings of the 2nd International Conference on Volcanic Ash and Aviation Safety*
- *Proceedings of the User Forum on Urban Meteorology*
- *National Hurricane Operations Plan*
- *Federal Meteorological Handbook No. 11-Doppler Radar*

Meteorological Observations; Part B-Doppler Radar Theory and Meteorology

- *Federal Meteorological Handbook No. 11-Doppler Radar Meteorological Observations; Part C-WSR-88D Products and Algorithms*

- *Federal Meteorological Handbook No. 11-Doppler Radar Meteorological Observations; Part D-WSR-88D Unit Description and Operational Analysis*

- *Federal Meteorological Handbook No. 12-United States Meteorological Codes and Coding Practices*

During FY 2004, OFCM continued to make substantial progress on its use of the Internet. In addition to information about the office, OFCM has placed its current publications on its Web site, and keeps the Web site current with information regarding workshops and forums being conducted by the office. OFCM will continue to make information available on the Internet during FY 2005.